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Flexible connection between sports device and shoe

CROSS REFERENCE TO RELATED APPLICATIONS

Applicants claim priority under 35 U.S.C. §119 of Austrian Application No. A 1890/98, filed on November 12, 1998. Applicants also claim priority under 35 U.S.C. §120 of PCT/AT99/00260, filed on November 3, 1999. The international application under PCT article 21(2) was not published in English.

The invention relates to a pivotable binding system between a sports device and a tread surface for a user's toot as well as a shoe and sports device for the binding system as outlined in the generic parts of claims 30, 51, 56 and 57.

WO 96/37269 A1 discloses a device for binding a shoe to a sports device. This device comprises a top part frame, which can be connected to a user's shoe, and pivotably connected to a bottom part frame by means of a hinge mechanism comprising a plurality of linking arms and joints designed to be fixed to various sports devices. The linking mechanism connecting the top to the bottom part frame is constructed so that a pivoting movement of the top part frame relative to the bottom part frame simultaneously causes the two part frames to slide relative to one another. Return spring means are additionally provided which elastically push the two part frames against one another into a predefined relative position. The disadvantage of this system is that correct operation can be easily impaired under difficult conditions of use.

WO 87/01296 A1 describes a binding system between a shoe and a sports device, in particular a binding for a touring ski, in which the articulated link to the sports device is disposed in the region assigned to the ball of the foot. As a result, the binding system for the user's shoe can be displaced into an upper, active position, which permits a pivoting action relative to the sports device about the articulated binding, and a lower, locked position in which the binding is prevented from pivoting. The disadvantage of this system is that it is difficult to switch the articulated binding from the active into the locked position and vice versa and the shear forces or twisting forces which occur between the sports device and the user's foot relative to a vertical axis place high demands on the parts used. Furthermore, when the binding system is in the active position, the central region of the sports device underneath the user's shoe is placed under a high degree of strain due to the fact that the bearing points are small in surface area or linear in shape. Another disadvantage is the fact that the front region of the sports device may rise if the user leans backwards.

FR 2 573 317 A1 discloses a binding system between a shoe and a sports device, which enables both a pivoting movement of the shoe relative to the sports device about a pivot axis running transversely to its longitudinal axis and, simultaneously, a relative displacement of the shoe in the longitudinal direction of the sports device. The disadvantage of this is that the user of this binding system is unable to get a firm hold on the sports device, which reduces performance. Another disadvantage is that the kickoff which can be achieved with this system is difficult to control and a

certain amount of instability in the kickoff is unavoidable, particularly if there is a change in ground conditions.

CH 659 397 A5 discloses a ski binding for crosscountry skiing. A first plate is provided, to which a ski shoe can be fixed. This first plate is joined to a second plate by means of a stable lever having two joints provided at its end regions. The second plate is of a design similar to a shoe sole so that it can be received by a conventional ski binding in a manner akin to a ski shoe. When this device is in the initial or rest position, in which the first plate and the second plate extend substantially parallel with one another, the first plate is supported so as to transfer load to the second plate. In addition, a flexible, resilient, stretchable tension strap is provided between the first plate and the second plate, which is stretched when the first plate is pivoted relative to the second plate and the movement of the first plate relative to the second plate is opposed by an elastic resistance and subsequently assists the return movement to the initial or rest position. This configuration produces a two-stage motion, whereby the connecting lever is pivoted jointly with the first plate into an end position during the first phase of movement and the joint facing the first plate does not become active until the end of this first phase of movement. These sequential pivoting movements about the two pivot axes of joints spaced apart from one another cause a disadvantageous, perceptible transfer of movement or a sudden jerk in the displacement after a certain pivot angle. This jerky movement occurs with the transition from the first pivoting phase to the second pivoting phase, namely when the displacement about the first joint has terminated

and the second joint, having a different centre of gravity, comes into play. A similar jerky movement occurs during the return to the initial or rest position.

FR 2 659 534 A1 discloses what is referred to as a collapsible skating shoe arrangement, in which a sport shoe is releasably joined as required to an articulated binding device with a skating shoe blade. This binding system comprises a jaw configuration displaceable by means of an operating lever, which can be coupled by a positive fit with a shaft bolt on the shoe side. This shaft bolt is secured in the front toe cap region of the shoe. In addition, this binding system additionally has a resilient, flexible counter-bearing, which is supported on the region of the tip of the foot and duly applies a mechanical resistance against an upward pivoting motion of the shoe. The disadvantage of this configuration is that the sport shoe is primarily pivoted about a rigid axis in the foremost toe region. The naturalness of the movement is impaired as a result.

The objective of the present invention is to provide a pivotable binding system between a user's foot and a sports device, which can enhance the performance of a user.

This objective is achieved by the invention due to the features outlined in claim 30 or 51. The particular advantage of this design is that relatively few and simple components imitate the natural rolling action of the foot across the bottom of the toes so that the performance of every user can be enhanced. Surprisingly, however, the enhanced performance which can be achieved by using the design proposed by the invention is not accompanied by any impairment to comfort. On the

contrary, comfort is perceptibly increased due to the harmonious or rounded movement of the binding system. The combined or largely rigidly coupled motion of the user's foot in translation and rotation relative to the sports device during the active phase of the binding system. i.e. when assuming a specific pivot position, gives the user a feeling of stability and functional safety. As a result, he can concentrate on the respective performance and does not have to consciously concentrate his efforts on a perfect rolling motion since this is pre-programmed by the binding system to a certain degree. Furthermore, the binding system consists of few individual components, which makes the design optimum in terms of weight whilst nevertheless enabling the advantageous rolling motion in translation and rotation. At the same time, any undesirable movement between the user's foot and the sports device, such as twisting about a vertical axis, can be reliably prevented, thereby producing a high resistance to force. Because of the small number bearing points, friction losses between the linking parts of the binding system can be kept particularly low, so that the use's potential to perform can be largely converted into kinetic energy to propel the sports device along. Another important advantage resides in the fact that the sole of the sport shoe, for example a cross country shoe, can be made to a more bend-resistant design than similar conventional sport shoes because the harmonious or flowing movement needed for an optimum forward propulsion can be produced by the binding device. The natural forward rolling motion across the heels when walking or running is simulated by the binding system proposed by the invention, thereby enhancing comfort when using the sports device. Because the sport shoe can be made relatively more resistant to bending, the driving energy applied by the user can be

more effectively converted into forward driving energy, thereby simultaneously enhancing performance without, as one might expect, impairing comfort.

The embodiment in a lateral guide device described in claim 31 makes the sport shoe easy to walk in without problems when removed from the binding system.

An embodiment as described in claim 32 is of advantage since the flexible binding element enables an unhindered pivoting action of the sport shoe relative to the sports device whilst nevertheless retaining the sport shoe in a longitudinal direction relative to the sports device.

Advantage is to be had from another embodiment defined in claim 33, whereby a long pivoting motion can be produced and no mechanical resistance has to be overcome in order to produce this pivoting motion.

A compact design of the spring means is provided as a result of the embodiment outlined in claim 34.

A robust and totally safe binding is achieved between the sport shoe and the sports device as a result of the advantageous embodiment defined in claim 35.

As a result of the embodiment described in claim 36, the sport shoe is firmly retained in the longitudinal direction of the sports device whilst affording the desirable play, namely the pivoting motion relative to the sports device about a horizontal axis.

The embodiment defined in claim 37 produces a harmonious motion largely simulating a natural walking motion, which significantly improves the performance of the user. Furthermore, a shoe sole that is relatively stable in shape can be used, thereby producing an optimum, immediate transfer of energy to the ground, generating an efficient forward motion.

The embodiment outlined in claim 38 leaves sufficient play for a rolling motion of the sport shoe across the rolling body without having to deform the actual shoe or shoe sole, right from the initial phase of the upward pivoting motion.

With the embodiment described in claim 39, the shoe tip region can be simultaneously displaced in the direction towards the sports device during the upward pivoting motion, counteracting any tilting motion of the sports device about its longitudinal axis relative to the sport shoe during kickoff, so that the kicking energy is transferred as far as possible without loss.

As a result of the embodiments described in claims 40-42, the sport shoe is held firmly on the sports device at the sides. Furthermore, because the strip-shaped binding system surrounds all

sides, the risk of the binding system buckling is minimised and any jerking movement of the sport shoe relative to the longitudinal direction of the sports device is effectively prevented.

Also of advantage is an embodiment of the type described in claim 43, whereby the sports device is able to achieve at least a linear contact without the need for additional measures and prevents the formation of any detrimental air gaps.

The preferred embodiment outlined in claim 44 provides the most varied of damping characteristics during the upward pivoting motion and exhibits a constant tendency to return to a defined initial position.

Relatively high damping forces or high pivoting resistance can be generated in a simple manner due to the embodiment outlined in claim 45.

The embodiment described in claim 46 counteracts any tendency of the sport shoe to lift from the sports device when pivoting about the ideal axis formed by the binding element.

Lifting movements of the shoe tip region from the sports device are also prevented even when the user is leaning backwards, due to the embodiment described in claim 47.

The embodiment defined in claim 48 is such that the sports device is not normally lifted by the underside of the shoe sole and the shoe sole is therefore always in contact with the sports device, affording a positive operating behaviour or positive feeling of motion.

Other advantageous embodiments of binding elements which are deformable on one side or have limited deformation capacity are set out in claims 49 and 50.

The preferred embodiment described in claim 52 advantageously causes a relative displacement between the tread surface or sport shoe and the sports device joined to it with every upward pivoting movement of the sport shoe relative to the sports device in the longitudinal direction thereof or in the direction of the usual forward movement or direction of travel, lengthening the strides accompanying the upward pivoting motion to enhance performance.
Also of advantage is another embodiment described in claim 53, since it always forces the sports device into a defined initial or rest position relative to the sport shoe.

The advantage of the embodiment described in claim 54 is that the lever can be accurately guided and is capable of withstanding high forces. Kinematically detrimental lever positions can also be prevented due to the fact that the pivoting motion is restricted.

Claim 55 describes another advantageous embodiment whereby every upward pivoting motion of the sport shoe relative to the sports device simultaneously results in a relative displacement

between sport shoe and sports device in the longitudinal direction of the sports device, thereby producing a mechanical lengthening of the stride.

The invention also relates to a shoe of the type defined in the generic part of claim 56. This shoe is characterised by the features described in claim 56. The resultant advantages can be found in the detailed description of the drawings.

The present invention also relates to a sports device, as described in the generic part of claim 57. This sports device is characterised by the features set out in claim 57. The resultant advantages can be found in the detailed description of the drawings.

In order to provide a clearer understanding, the invention will be described in more detail below with reference to the appended drawings.

Of these:

FIG. 1 is a very simplified, schematic diagram of a binding system as proposed by the invention for retaining a user on a sports device, seen from a side view;

FIG. 2 is a very simplified, schematic diagram of the binding system illustrated in FIG. 1 with the sport shoe pivoted upwards, e.g. during kickoff from the ground;

FIG. 3 is a cross section of the binding system along the lines III-III of FIG. 1;

FIG.4 is a very simplified, schematic diagram of another embodiment of the binding system proposed by the invention between a sport shoe and a sports device, having an additional hinge mechanism between the sport shoe and the binding element;

FIG.5 is a very simplified, schematic diagram of another embodiment of the binding system between a sport shoe and a sports device, seen from a side view;